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COOPERATION IN THE SEED POTATO INDUSTRY

Certification and quarantine officials representing fifteen seed producing and consuming states met in Chicago last fall to consider questions concerning the production and sale of seed potatoes. It was agreed that while difficulties were sometimes experienced with certified seed potatoes, the situation was not at all serious. For the most part, certified seed purchased by the southern growers has proven to be of excellent quality. Serious difficulty has, however, been experienced with selected seed potatoes and others which have not been certified by recognized agencies. Very often this seed shows large amounts of disease which results in serious reduction in yield.

The Potato Association of America has always been interested in the production of seed potatoes. An examination of the report of the seed potato certification committee will reveal the fact that much has been accomplished regarding the standardization of the regulations governing certification. This has resulted in a much more uniform product. There are still some important problems confronting the industry, however, and an organization such as suggested at Chicago would undoubtedly further the interests of the certified seed growers and at the same time protect the purchaser of seed potatoes.

At the Indianapolis meeting of the Potato Association of America, where this proposed organization was discussed it was agreed that the committee appointed at Chicago should be invited to work in cooperation with the Association. Marx Koehnke, chairman of the organization committee, has also been appointed chairman of the seed potato certification committee of the Potato Association of America. He is thoroughly acquainted with the seed potato industry and appreciates what the Potato Association has contributed to it. It is very much to be hoped that if the new organization is formed, it will decide to affiliate with the Association. This would be particularly desirable since it would be possible to use the American Potato Journal as a means of advising the potato grower of new developments in the seed potato industry.

BUILDING UP VIRULENCE IN PHYTOPHTHORA INFESTANS

DONALD REDDICK AND WILFORD MILLS

Cornell University, Ithaca, N. Y.

In tests conducted by Crosier and Reddick (2), *Phytophthora infestans* obtained from tomato (*Lycopersicum*) showed greater virulence on tomato and on resistant varieties of potatoes than did the same organism taken from potato. After a few generations (exact number not recorded) on slices of raw potato tuber, the culture from tomato was indistinguishable from cultures originally taken from potato and subcultured on raw tuber slices. The signifiance of the loss of virulence by the organism through a slight change in food source is sufficiently arresting but it would be further heightened by demonstrating that by so simple an expedient, virulence might be built up again. This has been done. A culture of *Phytophthora infestans,* originally obtained from potato foliage at Presque Isle, Maine, has been kept in susceptible tubers for six years. This culture has not undergone any detectable deterioration in the interim. It has been "invigorated" in March and in September each year by repeated passage through potato foliage. Routine tests of the culture always show usual fructification and swarmspore formation and the usual infection on such well-known susceptible varieties as Green Mountain or Russet Rural. The organism was taken directly from a tuber in which it had been dormant for about four months and was used to inoculate plants of five varieties. The usual reactions ensued: Green Mountain, wholly susceptible; Evergreen, somewhat resistant; President, considerable resistance; KB/5, immune as usual (unusually KB/5 has shown occasional lesions); ET/9, immune (always immune under all circumstances tested to date). Hereafter this culture will be called the "original" culture. In addition, lesions were produced on Green Mountain foliage with single swarmspores from the original culture. As all these lesions appeared to be exactly alike a single lesion was used as a source of spores for future inoculations. This "pedigree" culture had the same virulence as the original culture as was determined by inoculation. As rapidly as possible the pedigreed culture was passed

successively through the varieties Evergreen, President, and KB/5; and simultaneously and successively through Green Mountain. Passage through resistant hosts stepped up the virulence of the culture at once so that KB/5 was definitely susceptible. The culture passed through Green Mountain remained at the same level; when it was used for inoculation KB/5 and ET/9 it gave the usual immune reaction. The culture from KB/5 applied again to KB/5 gave evidence of increased virulence, that is, the reaction of KB/5 was now similar to the original reaction of Evergreen, but whatever the increase, it was not sufficient to bridge the gap between KB/5 and ET/9 and the latter variety remains in the class of immunes.

The original culture was raised in virulence to the level of the variety President and was then used to inoculate a hundred or more unnamed varieties which in previous tests had been classed as immunes. Under such circumstances several of these varieties were so susceptible that they had the appearance of blighted Green Mountain.

The pedigree culture taken from KB/5 was returned to susceptible Green Mountain. After one and two passages through this variety the virulence of the organism was not appreciably lowered as was indicated by inoculation on KB/5. At this point the work was interrupted by excessively high temperatures in the culture houses. It is evident from the work done that this subject requires more extensive investigation. Similar observations have been made with studies of other organisms but the number is not so large as could be wished.*

In September, 1937, blight appeared spontaneously in a field of approximately two acres in which 272 different lots of hybrids were growing. Because of the unusually late occurrence of the first killing frost it was possible to observe the spread of blight for a period of six weeks and to see a substantial duplication under natural conditions of the build-up of virulence which had been effected in the greenhouse. Circumstances absolutely preclude the possibility that the virulent culture which was developed in June could have reached this field. The original source of infection undoubtedly was a small lot of potatoes

*Just as this article was ready for the Editor, an article by E. J. Wellhausen entitled "Effect of the genetic constitution of the host on the virulence of *Phytomonas stewartii*" appeared in Phytopathology (27: 1070-1089. Nov. 1937). Dr. Wellhausen gives an adequate review of the literature. He also made some remarks in Ithaca in September 1936 which stimulated these tests, the need of which had been obvious enough since 1933.

paralleling the test field and removed only by a wide hedge row of high brush and trees. Lot KB/5 was nearest the source of infection but the first blight was found on the 3d of September on ZW/13, a plant known to be susceptible to the parasite taken from Green Mountain, and located about one hundred and fifty feet from the hedge row. The spore shower must have been general over the entire test area, and, in any case, could not have been less on KB/5 than on other lots. The blight was abundant on ZW/13 but was found in less amount on sibs 12 and 17. On the 6th of September the whole field was examined and blight was found on forty or fifty lots of plants all of which had been inoculated in March in the greenhouse and pronounced immune with "excellent infection on check plants". At this time blight could not be found on KB/5, although about one hundred plants of this variety were examined with the greatest of care. Finally, on the 22d of September large lesions were found on KB/5 and from the appearance of these lesions no one would be able to say that the variety possessed any resistance to blight. When killing frost finally came on the 15th of October the ZW sibs were all completely dead with blight but KB/5 had to be examined closely to see that the disease was abundant on it. A gap between KB/5 and about two hundred additional hybrids has not been bridged either naturally or artificially with the practical result that a great many kinds of potatoes having many of the characteristics of commercial sorts and to be classed as "blight proof" still exist.

It appears that in addition to a build-up of virulence by passage through resistant plants, a similar increase of virulence may be effected under some circumstances in one rather long jump. At any rate some experiences with KB/5 suggest this. Plants of KB/5 passed as "immune" in greenhouse tests, when examined two or three weeks later, have shown one or more lesions. Such lesions are most likely to appear on malformed leaves but they have been observed on leaves of ordinary appearance where they originated on frayed edges on, or between, folioles. In those instances observed the lesion seems, in some cases, not to have been visible at the end of the usual incubation period and in others not to have been recognized as a blight lesion at all or to have been passed as a "speck" reaction. As much as a month has elapsed before such lesions have been recognized and tested for the presence of the parasite. It is not very clear yet how it is that certain areas on a plant lose the usual resistance of the variety and thus give the parasite a foothold. The subsequent development of the parasite certainly suggests that the areas are few in number and limited in extent and that a real struggle ensues. In point of elapsed time viru-

lence can be built up faster by passage through successively more and more resistant hosts.

This plasticity of parasite suggests that the argument which has been advanced at one time or another by practically every one, including the writers, who have been engaged in the development of blight-resistant varieties, namely, that complete resistance, that is, immunity, is not necessary for practical results, may not be right. If the resistant variety were introduced into commerce it would have to undergo tests in comparison with standard sorts and would therefore be exposed eventually to conditions which would allow time enough for the parasite to build up virulence and perpetuate itself on the new variety. Thereafter the "buildup" presumably would be unnecessary and in any favorable year the parasite would be ready to begin normal processes with the advent of favorable conditions.

It is also likely that the differences in varietal resistance which are occasionally encountered in published lists from various countries are attributable not only to the occurrence of physiological races of the fungus but also to the difference in virulence of the parasite used rather than to differences in the variety itself. Here again the real difficulty lies in an inability to determine physiological differences among varieties all of which are susceptible enough to be killed by the parasite.

It appears permissible now to answer the hypothetical question which Pethybridge has asked perennially and for which a definite reply never has been forthcoming, namely (to paraphrase) "assuming that a blight-resistant potato is produced, what assurance is there that the parasite will not adapt itself to a new mode of living and thus continue the blight as usual?" The answer would appear to be "none."

Likewise, another of Pethybridge's pet inquiries may now be considered from another standpoint. Pethybridge and all others have been puzzled by an apparent loss of resistance to blight by the variety Champion. The conclusion is almost inescapable that in 1879 Champion was much more resistant to blight than were the popular varieties Regent and Victoria. It is highly desirable to determine, if possible, whether this same relation does not exist today. If it does a possible explanation might well be that *Phytophthora infestans* in Ireland in 1879 existed at the virulence level of varieties Regent and Victoria. Champion was a new variety (introduced in 1876) and may never have been exposed to blight before

1879. It is practically certain that the tubers of this variety which were in the trial plots in Ireland were healthy so that the fungus must have been introduced from neighboring fields. This circumstance alone would be sufficient explanation of the situation in an average year. The summer of 1879 in Ireland was, without doubt, exceptionally wet and cold. It is perhaps necessary, therefore, to allow that Champion is definitely more resistant than Regent and that the time consumed by the parasite in building up a virulence sufficient to overcome the recalcitrant Champion was also sufficient to give the practical result of slight loss in Champion and very heavy or even total loss in Regent and Victoria. The acreage of Champion increased very rapidly in Ireland after 1879 and at one time accounted for 80 per cent of the potato area, so that at the time Pethybridge came upon the scene he had to deal with the parasite ennobled to the level of Champion. If Champion is susceptible it is difficult at any time to demonstrate that another variety is more susceptible and it becomes practically impossible to do so when the parasite generally prevalent has virulence of the Champion level.

It is almost a foregone conclusion that without the experience with the hybrid varieties in the greenhouse, the conditions existing in the field would have been interpreted as evidence that a different biological strain of the fungus had appeared there. The existence of biological strains of *Phytophthora infestans* in certain parts of the world is not questioned. The only point to be made is that there is not here any support for Berg's conclusion that at least two strains exist in North America. In this connection it is interesting to note that in Berg's experience cultures of American origin failed to produce oospores, whereas such bodies did develop in cultures originating in Australia, Holland, and England. Without sexual reproduction the chance for sexual variants (biotypes) is eliminated and it is even likely that the chance for production of mutants is reduced even though somatic mutations are well known in several parasitic fungi.

This adaptation of the parasite to a variety of host conditions leads again to a consideration of the conditions which exist in the Piedmont region and elsewhere as between potato and tomato and its relation to the existence of biological strains in North America. Berg's (1) final account is accepted as a summation of the situation. Except for Berg's series 1 on potatoes (p. 11) everything contained in his report conforms with what has been recorded above. Berg's culture 3T (originally from tomato) inoculated on tomato was more virulent than were

cultures 1P and 2P (both originally from potato) on tomato. But when these cultures were used to inoculate potatoes "the disease produced by the tomato strain, 3T, did not progress with the same vigor as that produced by the potato strains, 1P and 2P". A repetition of this series gave similar results. On the bases of the virulence theory and of the experience of Reddick and Crosier (2) with cultures from tomato and potato, culture 3T should have given heavier infection on potato than did 1P or 2P. If it were possible to know the exact details involved (Berg's report covers experiments extending over a period of 5 years) it could be that even this apparent discrepancy would be found to substantiate the virulence theory. It becomes necessary to assume, however, that the culture from tomato had been kept on raw potato slices long enough for it to have run down in virulence to a point somewhat below the potato level before it was used to inoculate potato. Such an assumption is rather difficult to support. At any rate one may perhaps be permitted to conclude that the potato-tomato situation in North America needs further study before it can be cited surely as evidence of definite biological specialization.

SUMMARY

The virulence of *Phytophthora infestans* has been increased by passage through resistant varieties to a point where a number of hybrids which give an immune reaction in comparison with standard varieties were blighted severely. A similar build-up of virulence occurred under wholly natural conditions. A gap exists which has not been bridged either naturally or artificially so that many hybrids still exist which give no reaction whatever when inoculated with cultures of any virulence.

Some speculation is indulged in regarding the case of Champion, the potato-tomato situation in North America, and the occurrence of biological specialization.

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THE INFLUENCE OF ACID AND NEUTRAL FERTILIZER MIXTURES UPON THE YIELD OF POTATOES ON THE LIMED PLATS AT ONLEY, VIRGINIA.

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Prior to 1919 mixed fertilizers were either basic or only slightly acid-forming in the soil. Upon the introduction of ammonia salts in relatively large proportions into the fertilizer mixture they became acid-forming in nature. It was reported in a publication from this station that the yield of potatoes in Eastern Virginia was thought to be lowered because of the extremely acid condition in the soil. At this time a series of experiments with different liming materials was being conducted on the Eastern Shore of Virginia which substantiated this belief.

About 1934 non-acid-forming fertilizers were introduced. To obtain information upon the influence of acid-forming and non-acid-forming fertilizers upon the yield of potatoes and the prevalence of potato scab the limed plats at Onley, Virginia were divided into two sections. One section received fertilizers which were made neutral with dolomite, and the other section the acid-forming mixture. The fertilizer mixture used was sufficiently acid-forming to require four hundred pounds of ground limestone to make it neutral.

THE INFLUENCE OF LIME UPON THE YIELD OF POTATOES

It should first be pointed out that the soil under consideration was very acid. The check plats gave a pH reading of $4.5 \pm .3$. The limed plats that had received the equivalent of 3000 pounds of carbonate of lime during the past six years, gave a pH value of $5.0 \pm .25$ at harvest time in 1937. The yield of potatoes was 146.5 bushels to the acre on the check plats and 213.2 on the limed plats. These results show that the soil was sufficiently acid to give a substantial increase in yield due to the application of lime. However, the limed plats offered a varied condition of reaction for the testing of acid and neutral fertilizer mixtures.

The data given in the table show the results for the year of 1937. The yields of potatoes at Onley were somewhat low because of unfavorable weather conditions. It will be noticed that neutral fertilizers in-

creased the yield of potatoes 20 per cent on the unlimed plats where the pH value was 4.5 ± .3. The next largest increase in yield was on the plats receiving marl lime and the pH value was 4.9 ± .2. Where the pH value was 5.0 ± .3 or above, little or no increase in yield resulted from the neutral fertilizers as compared with the acid.

TABLE 1.—*Yields of prime potatoes obtained from acid and neutral fertilizer mixtures in the lime experiment at Onley, Virginia,* 1937.

Kind of Lime	Soil pH	Bushels per Acre		Per Cent Increase for Neutral
		Acid	Neutral	
Check	4.5 ± .3	146.5	175.9	20.0
Calcium hydrated	5.0 ± .3	203.9	216.3	6.0
Hydrated dolomite	5.0 ± .3	197.1	199.7	1.3
Marl	4.9 ± .2	202.9	225.6	11.1
Oyster shell	5.1 ± .2	230.1	224.8	—
Dolomitic limestone	5.0 ± .25	211.9	227.0	7.1
Calcium limestone	5.0 ± .25	222.8	197.1	—

NEUTRAL FERTILIZERS AND SCAB

Some growers had expressed the opinion that non-acid-forming fertilizer mixtures had increased the percentage of scabby potatoes in their fields. In order to test the influence of these acid-forming fertilizer mixtures on the limed plats the potatoes were graded and separated into groups of slightly scabby, severely scabby, and clean.

Scabby potatoes occurred in small spots in the field. The plats that received the lime had slightly more scabby potatoes than the check plats although the occurrence was very spotty. One plat showed as much as 12 per cent severely scabby potatoes whereas many others showed none.

Since the non-acid-forming fertilizer mixtures showed no significant difference from the acid-forming in the amount of scab that occurred on the potatoes, the data will not be given.

SUMMARY

Limed plats in these tests were divided into two sections and treated accordingly for the purpose of comparing acid-forming fertilizer mixtures. The non-acid-forming fertilizer mixture increased the yield of potatoes on the unlimed plats, but only slightly influenced it on the

limed plats. The neutral and acid-forming fertilizer mixtures showed no apparent difference in the severity of scab.

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THE INCIDENCE OF YELLOW DWARF IN POTATO VARIETIES

CARLTON F. TAYLOR

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Possible significance may be ascribed to an observation that potato varieties grown under the same conditions exhibit marked variations in the incidence of yellow dwarf, a virus disease of the potato. In 1935 potatoes planted in a varietal test developed considerable yellow dwarf. The symptom complex definitely indicated spread during the previous season, no symptoms of current-season spread developing at any time during 1935. The tubers planted in this test came from a replicated test of 1934 in which only one variety (Robson Seedling) developed a trace of yellow dwarf. This variety was not continued in the 1935 test under discussion. Regardless of whether the 1934 inoculum came from this variety or from an outside source, it is believed that the replication of the 1934 plots insured equal chances of inoculation and that the differences among the several varieties in 1935 indicate a difference in varietal susceptibility.

Since serious spread of yellow dwarf in the 1934 crop was unexpected, no insect population data are available. Data of this nature might throw considerable light on the subject because it is now known that the clover leaf hopper (*Aceratagallia sanguinolenta* Prov.) is a vector of the virus of yellow dwarf (1). Fortunately the plot plan of the 1934 experiment is available and it is also possible to reconstruct accurately a crop map of the immediately adjacent fields (figures 1 and 2).

BLOCK	1	2	3	4	5	6	7	8	9	10	11
A	1	8	3	5	9	10	4	2	**11**	6	7
B	7	4	1	2	5	3	9	10	6	8	**11**
C	3	10	2	8	6	5	**11**	4	1	7	9
D	10	7	5	9	**11**	6	2	3	8	4	1
E	2	9	4	3	8	7	1	5	10	**11**	6
F	**11**	2	10	6	7	9	8	1	4	3	5
G	9	1	11	4	10	8	7	6	5	2	3
H	8	5	7	11	2	1	6	9	3	10	4

N
W E
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FIGURE 1—PLANTING PLAN OF 1934 VARIETY TEST

ROW

1. Russet Burbank
2. Russet Rural
3. Number 9
4. Heavyweight
5. Irish Cobbler
6. White Blossom Cobbler
7. U. S. D. A. Seedling 44537
8. White Gold
9. Pioneer Rural
10. Columbia Russet
11. Robson Seedling

Thirty seed pieces planted in each plot.

The planting stock for 1935 was selected from these plots, starting with block A at the north end, by picking out tubers of suitable size until approximately one bushel was obtained. In this manner nearly all the seed was selected from the north end, but the number of plots from which tubers were taken varied with the plot yield and tuber size. High yielding varieties were represented by proportionately fewer tubers from the south half of the field. No data are available on the actual number of plots represented in each propagation sample, the only information being the system of selection. This factor may be, and probably is, immaterial, because no correlation exists between the 1934 yield and the 1935 incidents of yellow dwarf as shown in table 2.

As the Robson Seedling may have been the source of inoculum the 1934 plot plan is presented to show the position of the different varieties in each block (figure 1). Robson Seedling was planted in plot number 11. The record for 1934 does not show which plots of this variety had yellow dwarf and it is practically certain that the disease was not present in every plot. Nevertheless the data presented in table 1 suggest most strongly that proximity to this variety does not afford an explanation of the variation in incidence of yellow dwarf in the various varieties in 1935. It may be noted, for example, that White Blossom Cobbler was grown immediately adjacent to Robson Seedling at three places with 10.5 per cent yellow dwarf appearing in this variety in 1935, whereas Number 9, which on the basis of

proximity had the least chance of contracting the disease, actually showed 24.8 per cent diseased hills in 1935.

TABLE 1.—*Position of varieties with respect to Robson Seedling, 1934. Six north blocks considered (see bold face type, figure 1)*

	Immed. Adjac.	2 Row Distant	3 Row Distant	4 Row Distant	Yellow Dwarf Plants, 1935
	Times	*Times*	*Times*	*Times*	*Per Cent*
Russet Burbank	0	1	1	0	6.4
Russet Rural	**2**	1	0	1	11.8
Number 9	0	0	1	0	24.8
Heavyweight	1	1	0	0	22.8
Irish Cobbler	1	2	0	0	7.5
W. B. Cobbler	3	2	1	0	10.5
U. S. D. A. No. 44537	0	1	2	2	1.6
White Gold*	1	0	1	1	—
Pioneer Rural	1	0	0	3	33.1
Columbia Russet	1	1	2	1	48.4
Robson Seedling	—	—	—	—	—

* Not continued in 1935 test under discussion.

The 1935 test was planted on the 14th of June. Counts were made on the 17th of July and the 20th of August. The detectable yellow dwarf plants present at these dates were removed. The total number of yellow dwarf plants found during the season is presented in table 2.

TABLE 2.—*Pertinent data on the incidence of Yellow Dwarf in varieties of potato (based on five 30-hill plots of each variety)*

Variety	1934 Yield Per Plot	1935 Yellow Dwarf Plants	1936 Yellow Dwarf Plants
	Pounds	*Per Cent*	*Per Cent*
U. S. D. A. No. 44537	21.4	1.6	0
Russet Burbank	29.0	6.4	0
Irish Cobbler[1]	26.1	7.5	0
White Blossom Cobbler	20.4	10.5	0
Russet Rural	36.3	11.8	0
Heavyweight[2]	26.3	22.8	0
Number 9	34.7	24.2	0
Pioneer Rural[3]	40.1	33.1	0
Columbia Russet[4]	33.5	48.4	2.4

[1] White Blossom Cobbler is an undescribed variety obtained from Nova Scotia and said to be a natural seedling of Irish Cobbler.

[2] Heavyweight is a local variety of Rural New Yorker type and may be identical with Number 9.

[3] Pioneer Rural is an undescribed smooth mutant from Russet Rural.

[4] Columbia Russet is described in the American Potato Journal 14:93-99. 1937.

Evidence that current season spread was not a factor lies in the fact that no yellow dwarf developed late in 1935 and that the 1936 crop from this seed developed only 2.4 per cent yellow dwarf in the Columbia Russet and none in the others (table 1, last column).

It would appear from these data that the variation in incidence of yellow dwarf is probably caused either by varietal susceptibility or to klenducity that is, some varietal characteristic which affects the rate at which effective inoculation occurs. The evidence does not clearly indicate which is the causal factor.

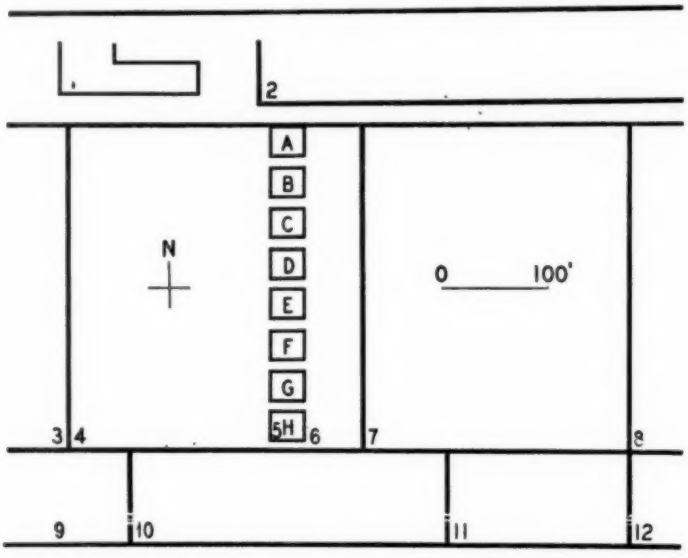

FIGURE 2—1934 CROP MAP OF FIELDS ADJACENT TO POTATO VARIETY TEST

1. Barn and shed with some weeds and grasses at rear.
2. Robson Seedling potatoes with 3 to 4 per cent yellow dwarf.
3. House and garage, surrounded by grass sod.
4. Vegetables of various kinds, from seed.
5. Potato variety test.
6. Onions, grown from seed.
7. Irish Cobbler potatoes with no yellow dwarf.
8. Old orchard in sod.
9. Spring grain with scant clover seeding.
10. Cabbage.
11. Early peas followed by beets.
12. Hay crop, alsike clover predominating.

Fields 9, 10, 11 and 12 are more than 600 feet long.

LITERATURE CITED

[1] Black, L. M. 1934. The potato yellow dwarf disease. Amer. Potato Journal 11:148-152.

REPORT OF THE POTATO VARIETY NOMENCLATURE COMMITTEE

The present chairman has continued the studies of stocks of potatoes listed by seed firms in many sections of the country. These studies are part of the plan under which is contemplated a survey to ascertain so far as possible what varieties are now in existence, also to determine which of the present-day names are synonymous with those of the old established varieties. Part of the lots included in the studies of the present season represent second-year tests. The remaining lots were added to the collection in 1937. The results of these studies are given below. All names in italics are those of the varieties with which the purchased stock appears to be identical. The indented names are those under which the different lots were received.

Irish Cobbler
- Early Eureka
- Early White King
- Extra Early Eureka
- Surprise
- Trust Buster

Triumph
- Salzer's Earliest

Early Ohio
- Early Six Weeks
- Extra Early Rockford

Spaulding Rose
- Early Long Six Weeks
- Beats Them All

Beauty of Hebron
- Bovee

Russet Burbank
- Golden Russet
- Scab Proof Golden Russet

Green Mountain
- Carman No. 3
- Delaware
- Early Michigan
- Fillbasket
- Gold Coin
- McKinley
- Pingree
- Prosperity

Rural New Yorker No. 2
- Carman No. 3
- Dooley
- Hiruco No. 9
- Pioneer
- Sir Walter Raleigh

This multiplicity of names emphasizes the need for standardization of the names of American potato varieties. It is believed that much could be accomplished in this direction by a committee or board appointed for a period of years possibly five, representing the Potato Association of America to serve as a referee in questions of nomenclature.

The United States Department of Agriculture is undertaking the collection and maintenance of stock of the potato varieties of this coun-

try which will provide material for study and data for classification purposes.

Dr. J. C. Miller offers the following suggestions: "I would like to emphasize the fact that, personally I think before any given new variety of potatoes is released to the general public, a sample should be sent to your Station at Presque Isle and the stock maintained; and that if a complete description has not been published by the person introducing the variety, such a description should be written up and published or at least remain on file for future reference. Also in introducing any new varieties, I think all State Stations as well as the Government Stations should use the same type of nomenclature and descriptive terms in describing any new variety. If any new terms are necessary, they should be passed upon by the Nomenclature Committee."

Professor C. H. Metzger has raised a fundamental question regarding the need for a criterion for determining what constitutes a strain. This should receive the attention of the committee. Professor Metzger writes as follows: "It seems to me that one of the first problems before the Committee on Nomenclature is a working definition of a variety and of a strain. It seems that there is considerable confusion, at the present time, and most of the confusion is caused by our lack of an adequate definition. For example, the workers in New York insist that within the Rural group as set up by Dr. Stuart, there are distinctly different varieties. We also have two or three cases here in Colorado. For instance, in our Peachblow potatoes we have three distinct types. One is a solid deep-red or magenta color; the second is a much paler color except in the eyes; and in the third, the skin is white with the color confined to the eyes. How should these be described to the trade and also in our seed inspection reports? Are these strains of Perfect Peachblow, and if so, how should they be designated? Or are they distinct varieties and each one entitled to a separate name? Another problem is the Bliss Triumph, varieties which we have separated into seven distinct types based on: season of maturity; height of vine: prevalence of blossoms; tuber set, tuber shape; and tuber color. How should these different types be designated? By separate names, or by numbers, or by some other method?"

Respectfully submitted,

C. F. CLARK, *Chairman*,
C. H. METZGER,
J. C. MILLER,
WM. STUART,
L. C. YOUNG.

REPORT OF THE CERTIFICATION COMMITTEE OF THE POTATO ASSOCIATION OF AMERICA

K. H. Fernow

Cornell University, Ithaca, N. Y.

Thirty-two states have now made some provision for certifying seed potatoes and a list of these with the name of the official in charge is herewith submitted. Of these states there are at least three which are inactive and five others in which the amount certified is negligible. Two other states produce less than 10,000 bushels of certified seed. The remaining twenty-two states produce amounts ranging from 10,000 to about 6 million bushels annually with the total annual production approximately ten million bushels. During the past three years Maine has produced more than half of the total and four states have produced more than three-fourths of the total.

It can be estimated that about forty million bushels of seed potatoes are used annually in this country. The question may be raised why only one-fourth of the seed used is certified. It should be borne in mind that in commercial potato areas which are suitable for seed production most growers produce their own seed. In many cases these growers have enough small, ill-shaped, cut and bruised potatoes sorted out of their commercial crop to plant a large part of their acreage. It will probably never be possible to replace much of this stock with certified seed. The biggest market available for certified seed is in those parts of the country where climatic or economic conditions make it inadvisable for the grower to produce his own seed. This is mainly along the Atlantic seaboard from Massachusetts south, in the southern states and locally in other parts of the country. It would seem that two factors principally interfere with this market being taken over by certified seed. One is lack of education as to the value of certified seed and the other is the higher price of certified seed. For several years the price of certified seed seems to have been inadequate to encourage the seed grower to stay in the business so there seems little hope of increasing consumption by lowering the price. The suggestion has been made that in order to meet this situation a type of certified seed should be provided which might have slightly more disease than that now certified and sell at a lower price. It is pointed out that in Scotland where the seed industry is well developed there are a number of different types of certificates issued according to whether the variety is im-

mune or not immune to wart and whether the leaf roll content is under 1 or under 3 per cent. Holland also has three classes of certified seed based on disease content and the locality where grown. In this country it has usually been assumed that certified seed is, or should be, a uniform product although some variation has been recognized especially in permitted grades. An alternative suggestion is that the present standards for certified seed be maintained or raised and that some other name be given to a less desirable but inspected type of seed. If such a policy were adopted on any extensive scale, development might be expected to take place along one of two lines. Either the certified seed trade would be largely destroyed and replaced by the cheaper seed so that certified seed would consist mainly of foundation stock for growing the cheaper seed or the present users of certified seed would continue to demand it and the cheaper recognized seed would take over the market now given over to selected and other kinds of uncertified seed with a possibility that in the long run the market for certified seed would be increased.

The committee is not prepared to advocate such a plan but presents it for consideration and discussion.

During the past year two events of interest to certified seed growers and users have taken place. The first of these was a meeting of potato growers and specialists of the state of Florida at which the following resolution was drawn up:

"WHEREAS, the Florida potato growers for years have been having great trouble in their potato production due to much disease being brought from other states and spread by the purchasing of this unfit and diseased potato seed despite the certification requirements of the various seed producing states and countries, the Florida growers find that the certification requirements of these states and countries either vary greatly or apparently are sometimes very poorly enforced.

"THEREFORE, be it resolved that, the U. S. Department of Agriculture make a study of potato seed certification now in effect in various states and after having made such a study, we, the Florida Potato Growers, recommended and urge the setting up of a very rigid Federal potato seed certification law to be operated, maintained, and enforced as a Federal Potato Seed Certification Service."

As learned by correspondence and conversation the experiences which led directly to the formulation of this resolution were that certified seed shipped to Florida in 1936 was in many cases severely infected with late blight, black leg, and bacterial wilt and soft rot. These diseases not only caused a tremendous loss of planting stock

before planting but a great reduction in stands and outbreaks of disease in the field and in the harvested potatoes on the way to market. These Florida growers feel that these diseases have been prevalent in certified seed also in other years and that adequate measures have not been taken for their prevention.

The other event referred to above was a meeting in Chicago, on the 26th and 27th of October of certification officials of seed producing states, quarantine officers of seed consuming states and other persons interested in the seed trade. The meeting was instigated by representatives of some of the southern states who wished to improve the quality of seed potatoes being shipped into their states. Twenty-two persons were present representing fifteen states. It was made very clear that no fault was being found with certified seed. The trouble was entirely with certain lots of selected and similar unrecognized classes of seed. The southern states wanted to establish a quarantine which would prevent the introduction of the worst of such lots and to that end requested the northern states to institute inspections of seed fields not entered for certification under some agreed-upon standard less strict than that for certified seed. This the northern officials felt they could not do and proposed that the southern states take steps to restrict the use of the word "seed" in connection with potatoes to those certified or otherwise recognized. The southern representatives felt this would be going too far but promised to take steps to restrict the misleading use of certain terms.

From the standpoint of certification the most noteworthy event of the meeting was the decision to organize a permanent group consisting of certification officials, quarantine officials, etc. A committee is now functioning to bring about such an organization.

The recommendations of the certification committee are as follows:

1. That inasmuch as the certification of potatoes was initiated by state agencies which are now well equipped to carry on this type of work and inasmuch as progress has been made and is being made towards the improvement of certified seed by these agencies we oppose any move to transfer the authority for seed certification to the Federal government.

2. As bacterial wilt and soft rot of potatoes, recently described, promises to be a serious disease and is known to be transported in seed potatoes, prompt steps be taken by all certifying agencies to prevent the certification of seed containing this disease. Until more is known about the disease even a trace should cause rejection.

3. Statistics on potato certification prepared by the Bureau of Agricultural Economics should be published in the American Potato Journal as soon as practicable.

4. Every support should be given to the effort to organize an association of seed potato agencies.

5. Certified seed should be graded U. S. No. 1 with a maximum size of 12 ounces, potatoes to be regarded as damaged by Rhizoctonia for seed purposes when the general appearance of the potatoes in the container is materially injured or when individual potatoes have more than 5 per cent of the surface covered in the aggregate, and by surface scab when the individual potatoes have more than 3 per cent of the surface covered in the aggregate.

6. It is recommended that the display of terms such as "mountain grown," "northern grown," and "non-irrigated" on certification tags be discontinued as misleading and irrelevant.

Respectfully submitted,

Committee on Certification,

E. M. GILLIG,
A. G. TOLAAS,
J. C. MILLER,
H. O. WERNER,
E. L. NEWDICK,
J. L. BUDREAU,
R. R. PAILTHORP,
W. H. MARTIN,
K. H. FERNOW, *Chairman.*

NAME AND ADDRESS OF PERSON IN CHARGE OF CERTIFICATION IN EACH STATE

H. W. Poulsen, Dept. of Agr., Sacramento, California.
C. H. Metzger, Agr. Exp. Sta., Fort Collins, Colorado.
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Tom Reid, New Mex. Crop Improvement Assoc., State College, New Mexico.
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E. B. Tussing, State University, Columbus, Ohio.
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S. F. Grubbs, Va. Crop Improvement Assoc., Blacksburg, Va.
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C. D. Gaines, Dept. of Agr., Olympia,, Washington.
F. Waldo Craig, Dept. of Agr., Charlestown, W. Virginia.
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John Tucker, Agr. Dept., Ottawa, Canada.

PRODUCTION OF CERTIFIED SEED POTATOES

In the following tables production figures show the total production of fields which passed the requirements for certification with no allowance for potatoes removed in grading or rejected by tuber inspections. These figures were furnished by the U. S. Department of Agriculture and the Dominion Botanist of Canada. The data for Canada are included for 1937 only.

TABLE 1.—*Production of certified seed potatoes by varieties*

Variety	State	Production			
		1934	1935	1936	1937
		Bushels	*Bushels*	*Bushels*	*Bushels*
Cobbler	Colorado	21,211	21,625	36,433	38,205
	Idaho	4,758	1,483	2,666	2,516
	Kentucky	9,110	7,135	3,375	2,450
	Maine	2,684,396	2,923,000	3,281,000	3,489,262
	Maryland	55,313	22,120	38,115	12,575
	Michigan	12,365	13,565	28,945	31,870
	Minnesota	426,384	823,548	350,575	965,800
	Montana	2,550	3,800	5,552	5,015
	Nebraska	3,903	23,550	8,875	8,480
	New Hampshire	.....	1,683	700	300
	New Jersey	95,427	37,176	51,257	71,844
	New York	125,000	136,760	72 490	61,600
	North Carolina	27,450	17,000	1,200	.....
	North Dakota	238,280	614,800	592,000	863,760
	Oregon	2,700	2,400	900	400
	Pennsylvania	20,225	22,708	25,042	6,799
	South Dakota	3,690	11,430	1,210	6,370
	Utah	12,375	15,600	11,520	8,460
	Vermont	39,000	31,075	28,987	23,988
	Washington	3,050	1,675	4,900	5,666
	Wisconsin	33,050	25,000	54,350	72,400
	Wyoming	7,000	17,500	4,980	1,800
	Total	3,827,237	4,783,633	4,605,072	5,679,560
	Canada				1,824,380
Green Mountain	Maine	2,569,336	2,271,000	2,491,000	3,723,083
	Maryland	50	.....	89	75
	Michigan	77,315	32,240	18,150	31,870
	Minnesota	6,118	5,044	7,345	16,104
	New Hampshire	35,325	26,163	25,758	24,790
	New Jersey	8,396	488	500	2,437
	New York	113,000	112,620	123,500	127,000
	North Carolina	13,800	3,300	875	100
	Pennsylvania	230	.....	.....	.....
	Vermont	168,000	119,900	146,650	87,875
	Wisconsin	10,450	12,500	9,500	6,500
	Total	3,002,020	2,583,255	2,823,457	4,019,834
	Canada				3,088,960

Variety	State	Production			
		1934	1935	1936	1937
		Bushels	*Bushels*	*Bushels*	*Bushels*
Triumph	California	50	83	167	.....
	Colorado	27,307	38,000	27,406	74,300
	Idaho	7,750	12,466	33,317	14,875
	Kentucky	.....	.....	450	245
	Louisiana	37,000	11,940	1,798	15,000
	Maine	.....	.....	72,000	132,953
	Michigan	.....	.....	.....	1,950
	Minnesota	118,771	274,598	175,700	453,548
	Montana	21,650	53,595	60,742	83,861
	Nebraska	191,725	788,080	153,280	504,995
	New York	.....	.....	14,118	29,000
	North Dakota	236,335	542,500	208,000	790,410
	Pennsylvania	.....	.....	7,500	.....
	South Dakota	2,680	6,365	4,767	9,285
	Utah	11,475	13,050	9,960	18,810
	Washington	2,267	710	2,133	2,700
	Wisconsin	88,260	132,000	85,325	86,250
	Wyoming	135,850	372,000	125,520	79,200
	Total	881,120	2,245,387	982,183	2,297,382
	Canada				768,600
Early Ohio	Idaho	1,508	708	766	723
	Minnesota	179,496	156,780	49,645	88,650
	Nebraska	.....	3,075	.....	.....
	New York	.....	.....	286	1,500
	North Dakota	151,415	268,800	91,000	100,590
	South Dakota	640	932	30	640
	Utah	1,275	4,800	2,280	1,890
	Washington	667	125	66	.....
	Wisconsin	575	.....	.....	.....
	Wyoming	200	200	.....	360
	Total	235,776	435,420	144,073	194,353
	Canada				44,750
Spaulding Rose	Maine	487,110	335,000	356,000	206,910
	Minnesota	.....	.....	.....	1,800
	New York	2,000	.....	.....	1,200
	Vermont	.....	1,700	1,625	.....
	Total	489,110	336,700	357,625	209,910
	Canada				31,920

Variety	State	Production			
		1934	1935	1936	1937
		Bushels	*Bushels*	*Bushels*	*Bushels*
Burbank	California	6,800	5,000	2,917	7,500
	Minnesota	.....	.....	.....	225
	Oregon	32,000	18,500	20,000	45,000
	Washington	300	525	1,000	1,400
	Total	39,100	24,025	23,917	54,125
Russet Burbank[1]	California	.....	28,333	44,167	50,000
	Colorado	2,670	1,100	4,370	8,750
	Idaho	120,463	88,366	138,650	188,422
	Michigan	.....	.....	700	.....
	Minnesota	7,519	2,082	1,370	1,995
	Montana	37,250	35,897	46,784	451,963
	Oregon	140,000	80,250	125,000	177,100
	Utah	9,075	8,100	11,040	16,740
	Washington	83,850	57,125	89,333	112,266
	Wisconsin	575	.....	800	650
	Total	401,402	310,253	462,214	607,886
	Canada				92,460
Russet Rural	Colorado	1,389	540	1,650	700
	Maine	.....	.....	113,000	78,035
	Maryland	6,500	5,325	3,281	1,706
	Michigan	245,810	150,360	134,179	135,754
	Minnesota	.....	.....	100	200
	New York	129,000	68,280	65,560	64,300
	Ohio	400	5,000	.....	.....
	Pennsylvania	161,050	101,334	134,853	103,291
	Wisconsin	12,300	8,200	6,400	7,100
	Total	556,449	348,039	459,023	391,086
Rural New Yorker[2]	Colorado	500	1,250	3,500	2,800
	Maryland	25,000	14,065	13,063	5,862
	Michigan	6,775	3,460	3,550	3,620
	Minnesota	1,196	1,280	640	810
	New York	154,000	79,090	98,370	91,200
	Pennsylvania	60,284	23,773	36,047	32,220
	Utah	1,550	375	480	186
	Wisconsin	31,708	20,500	23,500	37,450
	Total	281,013	143,793	180,050	174,148
	Canada				135,270

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Variety	State	Production			
		1934	1935	1936	1937
		Bushels	*Bushels*	*Bushels*	*Bushels*
Katahdin[3]	California	.....	167	417	1,333
	Colorado	.....	.....	4,995	13,980
	Maine	[4].....	[4].....	228,000	353,079
	Maryland	.....	.....	1,238	375
	Michigan	.....	8,581	19,768	14,255
	Minnesota	.....	1,280	1,470	2,016
	Montana	.....	3,900	2,762	2,645
	New Jersey	.....	2,564	780	3,531
	New York	.....	8,610	7,970	9,300
	North Carolina	250	200	125	.....
	Oregon	2,500	4,500	2,600	700
	Pennsylvania	.....	1,139	3,130	10,833
	Vermont	.....	1,740	2,275	2,175
	Wisconsin	3,000	3,500	1,850	3,825
	Total	5,750	36,181	277,381	418,047
	Canada				229,100
Chippewa[3]	Colorado	.....	.....	100	2,200
	Maine	[4].....	[4].....	152,000	518,609
	Michigan	.....	.....	5,210	20,889
	Minnesota	.....	4,633	6,335	17,496
	New Hampshire	.....	.....	591	1,699
	New Jersey	.....	90	485	9,885
	New York	.....	.....	1,790	37,800
	South Dakota	.....	.....	.....	80
	Vermont	.....	100	300	1,650
	Wisconsin	.....	.....	.....	1,150
	Total	.....	4,823	166,811	611,458
	Canada				21,450
White Rose[3]	California	.....	.....	26,667	26,667
	Colorado	.....	.....	410	.....
	Minnesota	.....	.....	34,000	35,250
	Montana	.....	.....	27,300	42,600
	Oregon	.....	2,200	11,000	19,500
	Washington	.....	.....	31,500	79,300
	Total	.....	2,200	130,877	203,317

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*Reg. U. S. Pat. Off. and Prin. Foreign Countries

Variety	State	Production			
		1934	1935	1936	1937
		Bushels	*Bushels*	*Bushels*	*Bushels*
Other Varieties[5]	California	13,600	29,067	10,833	11,667
	Colorado	371,967	289,943	391,545	273,430
	Idaho	1,925	4,250	9,000	8,300
	Maine	262,500	334,000	11,500	17,970
	Maryland	7,850	4,200	8,608	4,615
	Michigan	6,615	.....	.....	.....
	Minnesota	19,334	74,386	39,675	103,008
	Montana	6,000	22,880	692	6,680
	New Jersey	2,717	4,104	10,857	8,771
	New York	21,000	9,940	3,555	8,200
	North Dakota	2,280	4,200	1,980	20,860
	Ohio	.....	.....	.....	1,400
	Oregon	10,200	13,320	6,400	12,800
	Pennsylvania	.....	500	.....	52,070
	South Dakota	.....	.....	.....	75
	Utah	800	2,225	.....	.....
	Vermont	2,800	400	90	1,905
	Washington	11,300	18,983	3,799	2,533
	Wyoming	.....	.....	180	.....
	Total	740,888	812,398	498,714	534,284
	Canada				107,495
	Grand Total U. S.	10,450,865	12,064,107	11,111,397	15,395,390
	Grand Total Canada				6,344,385

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Stock Exchange Bldg., Baltimore, Maryland

Bangor, Maine **St. Stephens, N. B.**

TABLE 2.—*Certified seed potato production by states*

State	1933	1934	1935	1936	1937
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*
California	12,467	20,450	62,650	85,168	97,167
Colorado	505,965	425,044	352,458	470,409	414,365
Idaho	212,394	136,404	107,273	184,399	214,836
Kentucky	12,210	9,110	7,135	3,825	2,695
Louisiana	16,000	37,000	11,940	1,798	15,000
Maine	3,852,796	6,003,342	5,872,000	6,704,500	8,519,901
Maryland	72,572	94,713	45,710	64,394	25,208
Michigan	271,780	348,880	217,206	210,502	240,208
Minnesota	602,105	658,818	1,343,631	666,855	1,686,902
Montana	60,845	67,450	120,072	143,832	192,764
Nebraska	552,263	195,628	814,705	162,155	513,475
New Hampshire	29,666	35,325	27,846	27,049	26,789
New Jersey	123,908	106,540	44,422	63,880	96,468
New York	520,000	544,000	415,300	387,729	431,100
North Carolina	9,100	41,500	20,500	2,200	100
North Dakota	918,150	628,310	1,430 300	892,980	1,775,620
Ohio	8,000	400	5,000	0	1,400
Oregon	185,300	187,400	130,170	165,900	255,500
Pennsylvania	137,165	241,789	149,454	207,472	205,213
South Dakota	3,945	7,010	18,727	6,007	16,450
Utah	.....	36,550	42,150	35,280	46,086
Vermont	183,100	209,800	154,915	179,927	117,593
Washington	101,966	101,434	79,143	132,731	203,865
Wisconsin	149,450	179,918	201,700	181,725	215,325
Wyoming	303,950	143,050	389,700	130,680	81,360
Total	8,845,097	10,459,865	12,064,107	11,111,397	15,395,390
Canada					6,344,385

[1]Netted Gem and Russet Burbank are probably the same variety.
[2]Also called White Rural or Smooth Rural.
[3]These varieties heretofore were included under "other varieties", and some of the production in 1934 and 1935 may still be included under "other varieties."
[4]Production data not available. Acreage of Katahdin certified in 1934 was 125; in 1935 it was 598. Acreage of Chippewa certified in 1934 was none; in 1935 it was 30.
[5]Includes Idaho Rural, which formerly was listed separately.

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SECTIONAL NOTES

ALABAMA

Weather conditions in the commercial potato section have been ideal, and planting has been conducted under very favorable conditions. The general appearance and the condition of the seed have been good. It appears that approximately 18,000 acres of potatoes will be planted in South Alabama. Of this amount Baldwin County will plant about 15,000, Escambia County 2,300, and Mobile County about 700 acres. (Feb. 17).—L. M. WARE.

ARKANSAS

Planting for 1938 will be slightly below normal. The acreage will be fairly well maintained around the two larger shipping centers, near Fort Smith and in the eastern part of the state. Seed has not yet arrived, but will arrive about the middle of February. There is very little interest in the potato control plan. (Feb. 7).—P. T. ECTON.

NORTH CAROLINA

Some of our potato growers have already started to plant. The indications are that there will be about a 20 per cent reduction in the acreage planted in North Carolina this year. Later information may change this figure somewhat, but I believe that there will be a considerable reduction in the early potato acreage. (Feb. 11).—ROBERT SCHMIDT.

TEXAS

In the Rio Grande Valley, plantings were made in January for the April harvest. The 1938 acreage is about the same as for 1937.

In Eagle Lake, Sugarland, and Wharton areas plantings are being made at this time, and are about the same as in 1937. The total acreage for this area is below the ten-year average. Potatoes are also being planted in the Northeast Texas area and will continue until the 15th of March. The acreage in this area will be less in 1938 than in 1937.

All of the above areas have planted the Bliss Triumph variety for the early market. (Feb. 12).—J. F. ROSBOROUGH.

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Potatoes that blacken after cooking and come on the table dark and soggy were not grown with enough potash. Housewives object, and particularly in years of large production and careful grading and advertising will purchase only those potatoes which they can be sure will cook up white and mealy. Do not risk the chance of having your crop take a back seat on competitive markets. It costs only a few cents more per bushel to make sure that your potatoes receive enough potash to grow the No. 1 quality that will get all of the profit to be had.

Potatoes remove from the soil more potash than both nitrogen and phosphoric acid combined. A yield of 300 bushels per acre uses 170 pounds of actual potash per acre in addition to what must be supplied to take care of leaching, erosion, and soil fixation. Consult your county agent or experiment station about the fertility of your soil. See your fertilizer dealer or manufacturer about getting the right amount of potash in your potato fertilizer.

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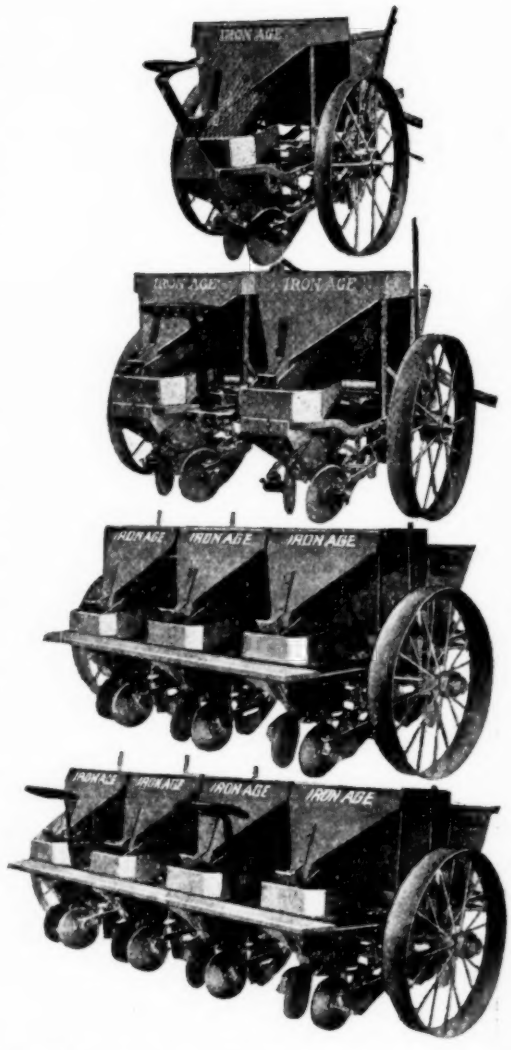

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